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ABSTRACT

Social inadequacy and lack of social cooperation is one of the defining characteristics of mental deficiency, yet there have been comparatively few investigations into how such children respond to each other. Of even greater significance is the finding that among the reported studies investigating social cooperation between mentally deficient children, there commonly is involved novel apparatus which might in itself have a significant influence upon the cooperative behaviour of the subjects. An experiment was performed to test the hypothesis that use of a novel apparatus will significantly enhance the effects of positive reinforcement of cooperative behavior between two autistic children. Reinforcement alone was found to increase cooperative behavior and reduce uncooperative behavior to a significant degree. These effects were maintained (up to an optimal fixed-ratio schedule), but not significantly increased, when reinforcement and apparatus were used simultaneously. The use of apparatus without reinforcement was found to have no significant effect; in fact, there was some indication that the apparatus might have negative effects on cooperative behavior. It was concluded that use of the apparatus was, at best, irrelevant to the establishment of cooperative behavior. (Author)

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A COMPARISON OF THE EFFECTS OF DIFFERENTIAL REINFORCEMENT AND APPARATUS ON COOPERATIVE BEHAVIOR IN TWO AUTISTIC CHILDREN

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Abstract

An experiment was performed to test the hypothesis that use of a novel apparatus will significantly enhance the effects of positive reinforcement of cooperative behavior between two autistic children. Reinforcement alone was found to increase cooperative behavior and reduce uncooperative behavior to a significant degree. These effects were maintained (up to an optimal fixed-ratio schedule), but not significantly increased, when reinforcement and apparatus were used simultaneously. The use of apparatus without reinforcement was found to have no significant effect; in fact, there was some indication that the apparatus might have slightly negative effects on cooperative behavior. It was concluded that use of the apparatus was, at best, irrelevant to the establishment of cooperative behavior.

Social inadequacy and lack of social cooperation is one of the defining characteristics of mental deficiency (Heber, 1959; Sarason & Galdwin, 1958; Spradlin et al., 1967). It is therefore surprising to

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find that in spite of this widespread acknowledgement there have been comparatively few investigations into how such children respond to each other. Of equal significance is the finding that among the reported studies investigating social cooperation between retarded, mentally deficient, or even normal children, there commonly is involved apparatus which might in itself have a significant influence upon the cooperative behavior of the subjects. For example, Mithaug and Burgess (1967, 1968), in concluding that individual reinforcement was both necessary and sufficient for establishing cooperative behavior between children, used apparatus which consisted of three, 14-key piano keyboard instruments wired to a counting device on the experimenter's desk. Each of the three children (five to twelve years old), simultaneoulsy pressing a predesignated key, activated a light for reinforcement. The influence of the novel apparatus on the cooperative behavior obtained is unknown.

Findings that cooperative responses gradually increase in frequency when reinforced and gradually decrease in frequency during extinction appear to be more marked in experiments which involved the use of novel apparatus (e.g. Azrin and Lindsley, 1956; Hintgen et al., 1965; Hollis, 1966) rather than in similar studies which have not involved apparatus (e.g. Carlin and Armstrong, 1968; Jorgenson and Parnell, 1970; Vogler, 1970). It was therefore hypothesized that use of novel apparatus would significantly enhance the effects of reinforcement of cooperative behavior between autistic children.

METHOD

Subjects were drawn from a population of seven autistic children in a day-care treatment programme at the Clarke Institute of Toronto.

Alex was a six year old boy who had developed some functional speech, but he was markedly withdrawn and rarely attempted to interact socially with the other children. Danny was a five year old boy who displayed a somewhat more developed use of language (approximately that of an average three year old). He exhibited high distractibility and occasional aggressive behavior toward the other children.

Procedure. The subjects participated together in sessions which lasted ten minutes and occurred twice a day, once in the morning and once in the afternoon. The experimenter sat beside the subjects at a table in a sound-proof room, which had a one-way observation mirror and an intercom system. A piece of paper and crayon were placed between the subjects and the task called for the children to draw a picture together. Both subjects had developed sufficient fine motor skills to enable them to draw a simple figure, such as a face or a house. Brief instructions were given to both subjects prior to beginning each session, the duration of which was measured by the use of a stop-watch. The experimenter then recorded the frequency of occurrence of cooperative and uncooperative responses. Cooperative behavior was defined as inviting (either verbally or gesturally the other child to have a turn, or attending to what the other child was doing for two or more seconds. Uncooperative behavior, or that which was incompatible with participation in the goal-directed activity, was defined as physically disturbing the other child

(e.g., refusing to share the crayon at request, refusing to participate).

To assess reliability of measurement, periodic observational checks were made by staff not directly involved in the experiment. These data indicated an agreement of above 90% on observed responses.

Conditions. The subjects were involved in eight experimental conditions in which the two variables, apparatus and differential reinforcement, were manipulated.

The apparatus consisted of a crayon tied to each end of a length of string which ran through an eyelet fixed to the top of the table. The length of the string was such that only one child could draw at a time, because as soon as one child brought his crayon to where the paper was placed, the other crayon moved beyond the edge of the sheet. Co-operation was therefore needed for both children to contribute to the drawing.

In reinforcement conditions, the experimenter reinforced cooperative responses with a small piece of food which had demonstrated reinforcing value for the child in previous training situations, together with verbal praise for the behavior ("Good helping", or "Good watching"). Uncooperative responses were punished with a "time-out" procedure, viz. removing the child a short distance from the table for a duration of one minute.

In Condition I, a base period, cooperative and uncooperative behaviors were observed without the introduction of apparatus or reinforcement. In order to assess the effects of reinforcement alone, differential

reinforcement was introduced in Condition II, and withdrawn in Condition III which was a reversal to the baseline condition. Then, in order to assess the effects of apparatus with and without reinforcement, the apparatus was introduced alone in Condition IV, reinforcement was added in Condition V, and then reinforcement was withdrawn in Condition VI. In a seventh condition, apparatus was combined with a fixed ratio 2:1 schedule of reinforcement schedule up to a 1:8 ratio. Table 1 outlines this series of conditions and presents the design employed to evaluate whether the novel apparatus influenced cooperative behavior, and also whether reinforcement (with and without apparatus) significantly affected cooperative behavior between the two subjects.

Insert Table 1 about here

RESULTS

Figure 1 presents the two subjects' cooperative and uncooperative responses over the eight experimental conditions.

Insert Figure 1 about here

The mean cooperative and uncooperative scores and their standard deviations are presented in Figure 2.

Insert Figure 2 about here

The introduction of reinforcement without apparatus in Condition II (following the establishment of a baseline in Condition I) significantly increased cooperative behavior and decreased uncooperative behavior. Extinction during Condition III demonstrated the effectiveness of reinforcement, as cooperative behavior decreased rapidly and uncooperative behavior increased slightly. The introduction of the apparatus without reinforcement during Condition IV made no significant difference to the subject's cooperative behavior, and even markedly decreased Danny's uncooperative responses.

A marked return to cooperative behavior occurred during Condition V when reinforcement was reintroduced with the apparatus. Condition VI (when only the use of the apparatus was continued) resulted in essentially the same pattern as presented within Condition IV, viz., a significant decrease in cooperative behavior and a marked increase in Danny's uncooperative responses. When the reinforcement was reintroduced on a fixed ratio schedule of every other response, and the use of the apparatus was continued (Condition VII), cooperative behavior of both subjects increased very significantly and uncooperative behavior decreased.

During Condition VIII (no apparatus), the reinforcement ratios were varied considerably, and the cooperative responses varied accordingly. When the fixed ratio was increased from 1:2 to 1:4, both subjects' cooperative responses increased significantly (and the uncooperative responses decreased), but beyond this ratio (i.e., 1:5 to 1:8) cooperation declined significantly, and Danny's uncooperative responses again showed an increase.

Both subjects' scores were combined to give a mean cooperative and uncooperative response under each condition. t tests were then used to investigate the statistical significance of between-condition differences. These data are presented in Table 2.

Insert Table 2 about here

DISCUSSION

The increased rate of cooperative responses and decrease of uncooperative responses under reinforcing conditions clearly support the findings of previous studies such as those reported by Mithaug and Burgess (1967, 1968), Cohen (1962), Azrin and Lindsley (1956), Jorgenson and Parnell (1970, and Vogler (1970).

It is also clear that the apparatus not only failed significantly to increase cooperative behavior, but contributed to an increase in uncooperative responses even during reinforcement conditions. Thus the effects of positive reinforcement upon cooperative behavior appear to be greater without apparatus in the present study.

The introduction of a contingency variation with thinner schedules of reinforcement accelerated the cooperative effect for FR-2 schedules but not for the higher ratios. The contingency effects also seemed to operate independently of the use of apparatus. The FR-2 and FR-3 schedules appear to produce optimal results on cooperative behavior while higher ratios show extinction effects. The final condition with its sequences of

varying contingencies is a form of random schedule of reinforcement. The finding that the highest mean cooperative scores were recorded under these conditions gives support to Bandura's (1969) argument that a random schedule of reinforcement facilitates the highest rate of responding and the greatest resistance to extinction.

Thus the results of this study support the findings of the majority of the operant conditioning studies which have investigated cooperative behavior, i.e., that reinforcement slightly increases cooperative responses. Of special significance is the fact that this study has also demonstrated that reinforcement is effective whether apparatus is involved in the experimental design or not. There is, in fact, some suggestion that apparatus may inhibit cooperative behavior in some instances.

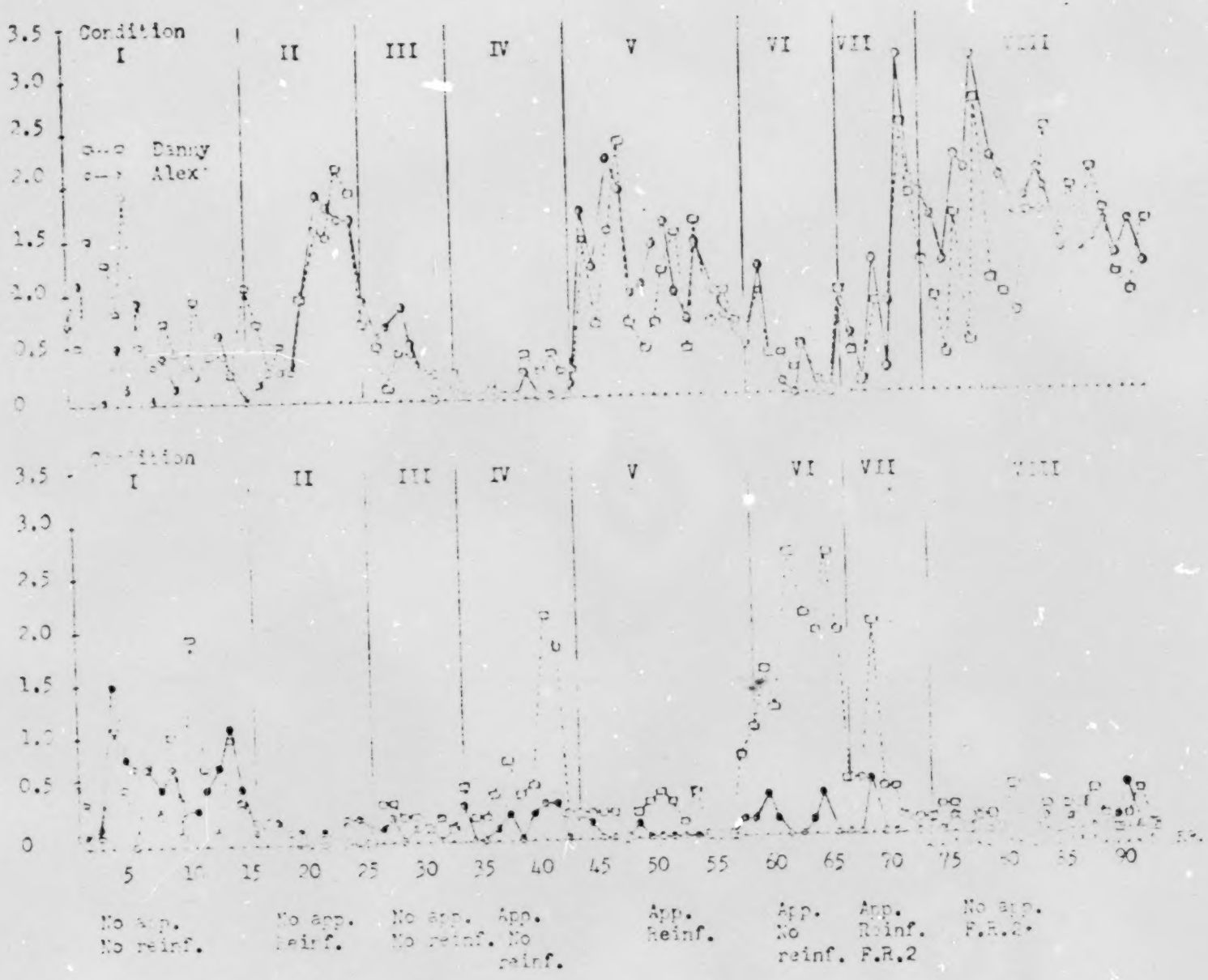

Figure 1: Cooperative and Uncooperative Response Rates

ALEX

CONDITION	COOPERATIVE MEAN	COOPERATIVE STD. DEV.	UNCOOPERATIVE MEAN	UNCOOPERATIVE STD. DEV.
I	0.37	0.34	0.58	0.38
II	0.88	0.61	0.12	0.08
III	0.51	0.29	0.09	0.06
IV	0.03	0.07	0.14	0.13
V	1.15	0.56	0.03	0.06
VI	0.3	0.4	0.11	0.12
VII	1.13	1.07	0.09	0.19
VIII	1.68	0.46	0.05	0.1

DANNY

CONDITION	COOPERATIVE MEAN	COOPERATIVE STD. DEV.	UNCOOPERATIVE MEAN	UNCOOPERATIVE STD. DEV.
I	0.73	0.49	0.59	0.5
II	1.1	0.67	0.06	0.08
III	0.34	0.22	0.17	0.1
IV	0.13	0.13	0.68	0.7
V	0.96	0.59	0.21	0.19
VI	0.32	0.25	1.89	0.62
VII	1.0	0.8	0.57	0.65
VIII	1.32	0.61	0.12	0.12

Figure 2: Mean Cooperative and Uncooperative Responses and their Standard Deviations for Each Condition

TABLE 1

EXPERIMENTAL DESIGN TO EVALUATE EFFECTS OF REINFORCEMENT--WITH AND WITHOUT APPARATUS--FOR COOPERATIVE DRAWING BEHAVIOR

CONDITION	STIMULUS	CONTINGENCY
1 (a)	no apparatus	no reinforcement
2 (b)	no apparatus	reinforcement
3 (a)	no apparatus	no reinforcement
4 (c)	apparatus	no reinforcement
5 (d)	apparatus	reinforcement
6 (c)	apparatus	no reinforcement
7 (d)	apparatus	reinforcement (thin contingency)
8 (b)	no apparatus	reinforcement (thin contingency)

TABLE 2

t SCORES FOR BETWEEN-CONDITIONS COMPARISONS

COOPERATIVE RESPONSES

CONDITION	1	2	3	4	5	6	7	8
I		-3.06**	.4NS	3.68**	-4.29**	1.33NS	-2.84**	-8.26**
II			2.91**	5.51**	-0.32NS	3.46**	0.24NS	-3.05**
III				5.45**	-4.11**	1.16NS	-2.65**	-7.37**
IV					-7.49**	-2.0NS	-4.79**	-11.26**
V						4.78**	-0.04NS	-3.37**
VI							-3.09**	-8.03**
VII								-2.17NS
VIII								

UNCOOPERATIVE RESPONSES

CONDITION	1	2	3	4	5	6	7	8
I		5.01**	2.11*	1.26NS	5.49**	-1.92NS	1.78*	6.86**
II			-1.41NS	-2.52*	-0.77NS	-4.02**	-1.95NS	0.6NS
III				-1.97NS	0.23NS	-3.43**	-1.44NS	1.2NS
IV					2.68**	-2.22NS	0.47NS	3.48**
V						-4.7**	-1.94NS	0.89NS
VI							2.26*	5.67**
VII								2.64*
VIII								

Underlined scores indicate two-tailed tests

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